

eBird Best Practices

eBird Data Extraction and Processing in R

The Cornell Lab  of Ornithology

eBird

is a an online database of bird observations collected by citizen scientists, providing real-time data about the global distribution and abundance of bird species.

Mon 2 Jul 2018 1:11 PM

[Edit Date and Effort](#)

Winter Trail, Alaska, US (71.251, -156.491)

North Slope County, Alaska, United States

[Edit Location](#)

Matthew Strimas-Mackey

Andrew Spencer , Ian Davies ,
Nathan Pieplow

Traveling Complete

Are you submitting a **complete checklist** of the birds
you were able to identify? Yes[Learn more](#)

4 people 1 hr, 50 min 2.37 mi



Submitted from eBird Android, version 1.9

[Edit comments](#)**SUBMIT ANOTHER FOR...****Same location and date**

Winter Trail, Alaska, US (71.251, -156.491), North Slope County, Alaska, US on Mon Jul 02, 2018

Same location

Winter Trail, Alaska, US (71.251, -156.491), North Slope County, Alaska, US

Same area and date

Another location near Winter Trail, Alaska, US (71.251, -156.491), North Slope County, Alaska, US on Mon Jul 02, 2018

Same area

Another location near Winter Trail, Alaska, US (71.251, -156.491), North Slope County, Alaska, US

Same date

Mon Jul 02, 2018

Different location and date

MEDIA POWERED BY MACAULAY LIBRARY

23

Species observed

+1 other taxa

150 **Greater White-fronted Goose**1 **Tundra Swan**15 **Northern Pintail**1 **Spectacled Eider**

BREEDING CODE: NE Nest with Eggs (Confirmed)

3 **King Eider**25 **Long-tailed Duck**120 **American Golden-Plover**

Presumably failed breeders

12 **Dunlin**

BREEDING CODE: NE Nest with Eggs (Confirmed)

20 **Pectoral Sandpiper**

BREEDING CODE: NE Nest with Eggs (Confirmed)



2

Species with photos

645 million

observations

461,509

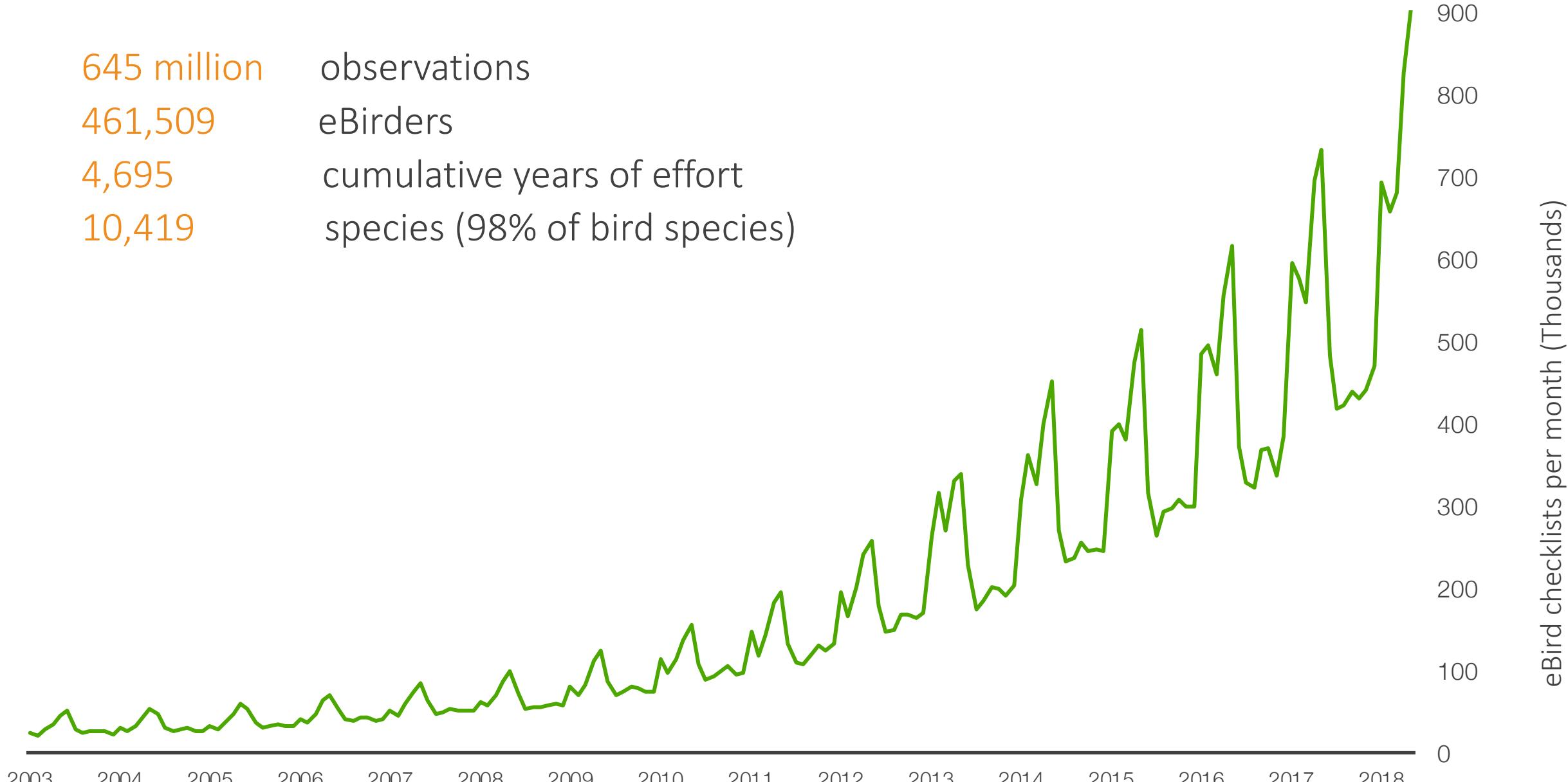
eBirders

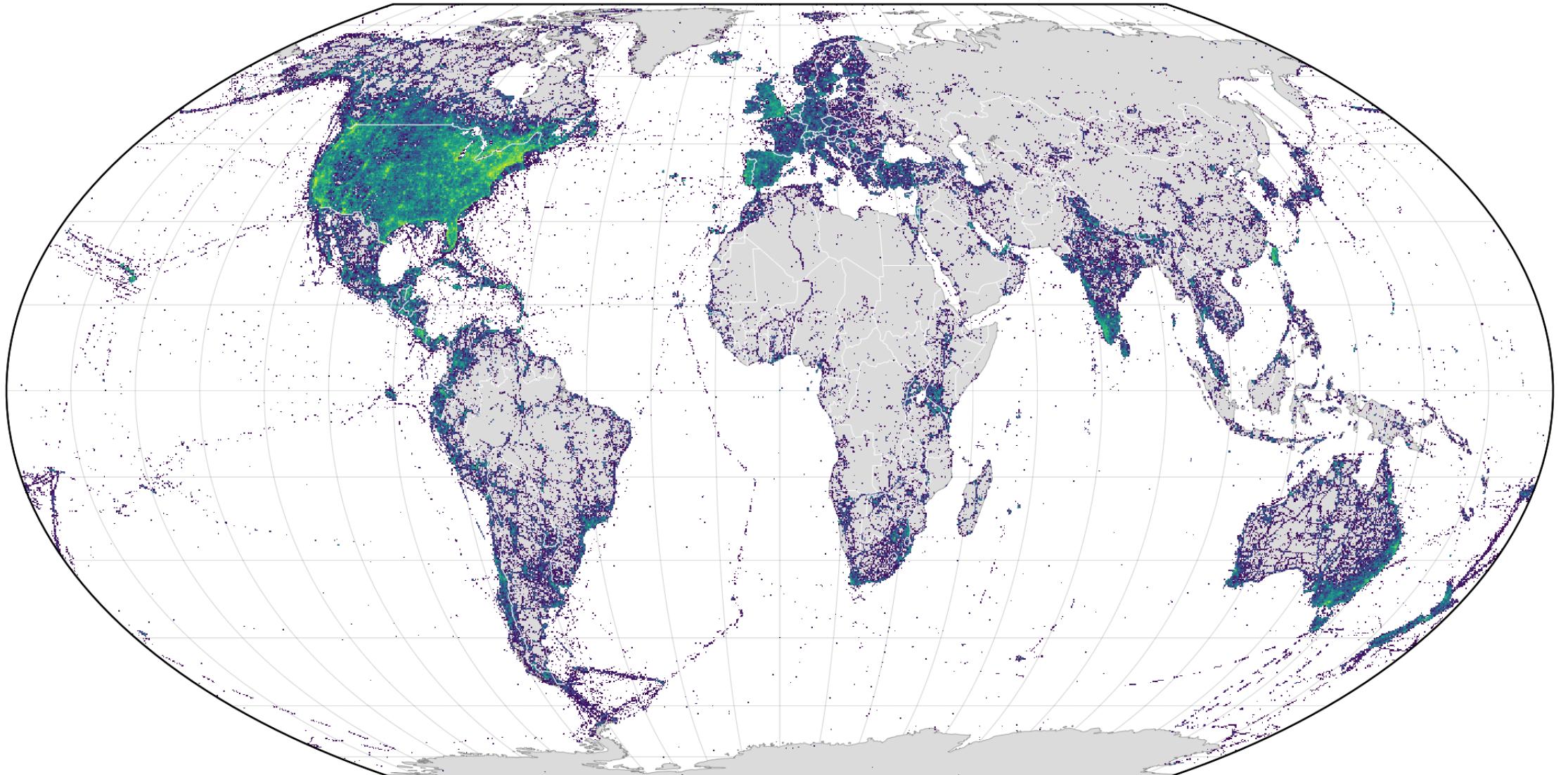
4,695

cumulative years of effort

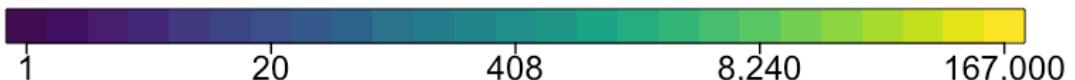
10,419

species (98% of bird species)





eBird checklists per 25 km grid cell



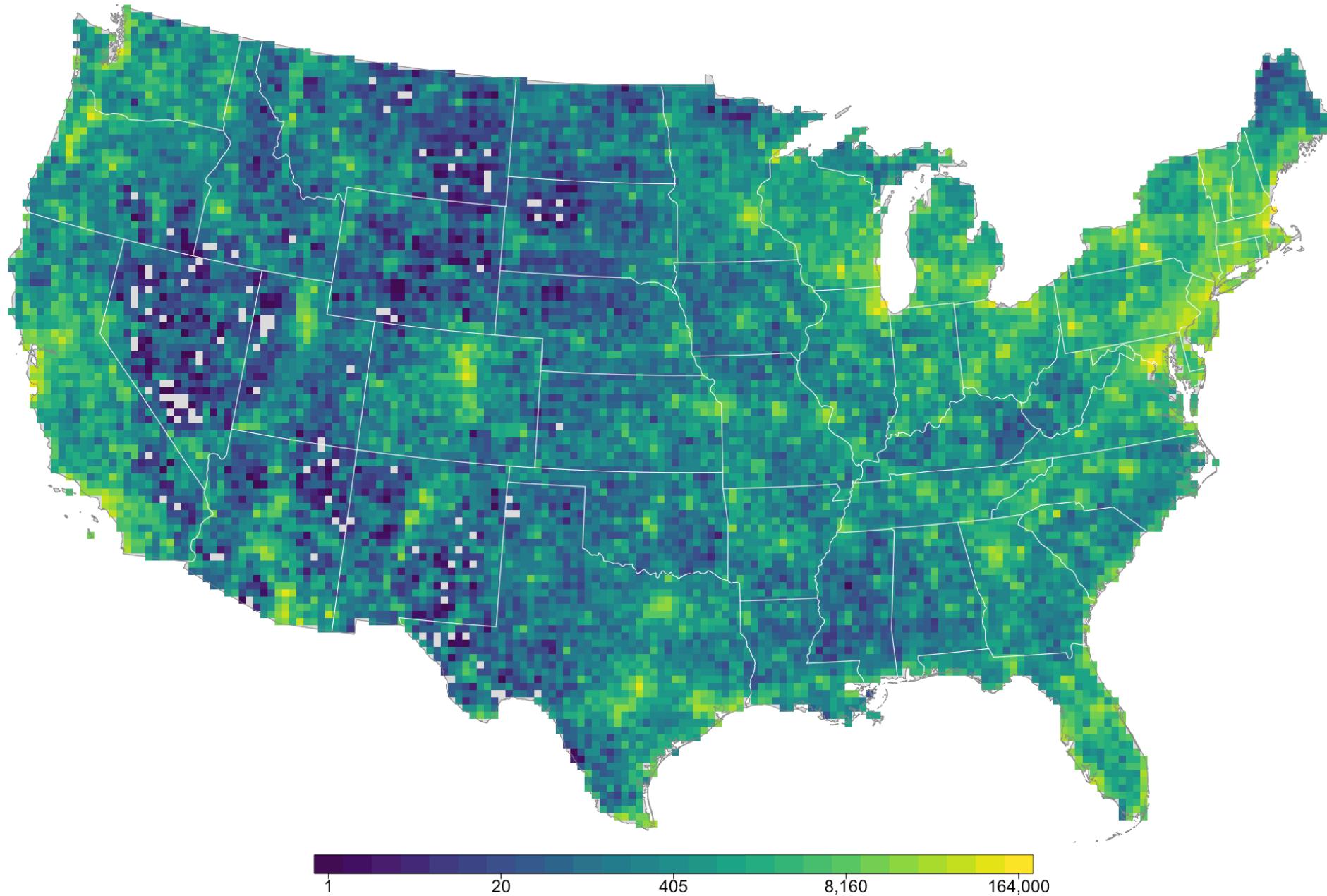
1

20

408

8,240

167,000



How do I access eBird data?

- 1** eBird website
- 2** eBird Status and Trends
- 3** Accessing raw eBird data

Species:

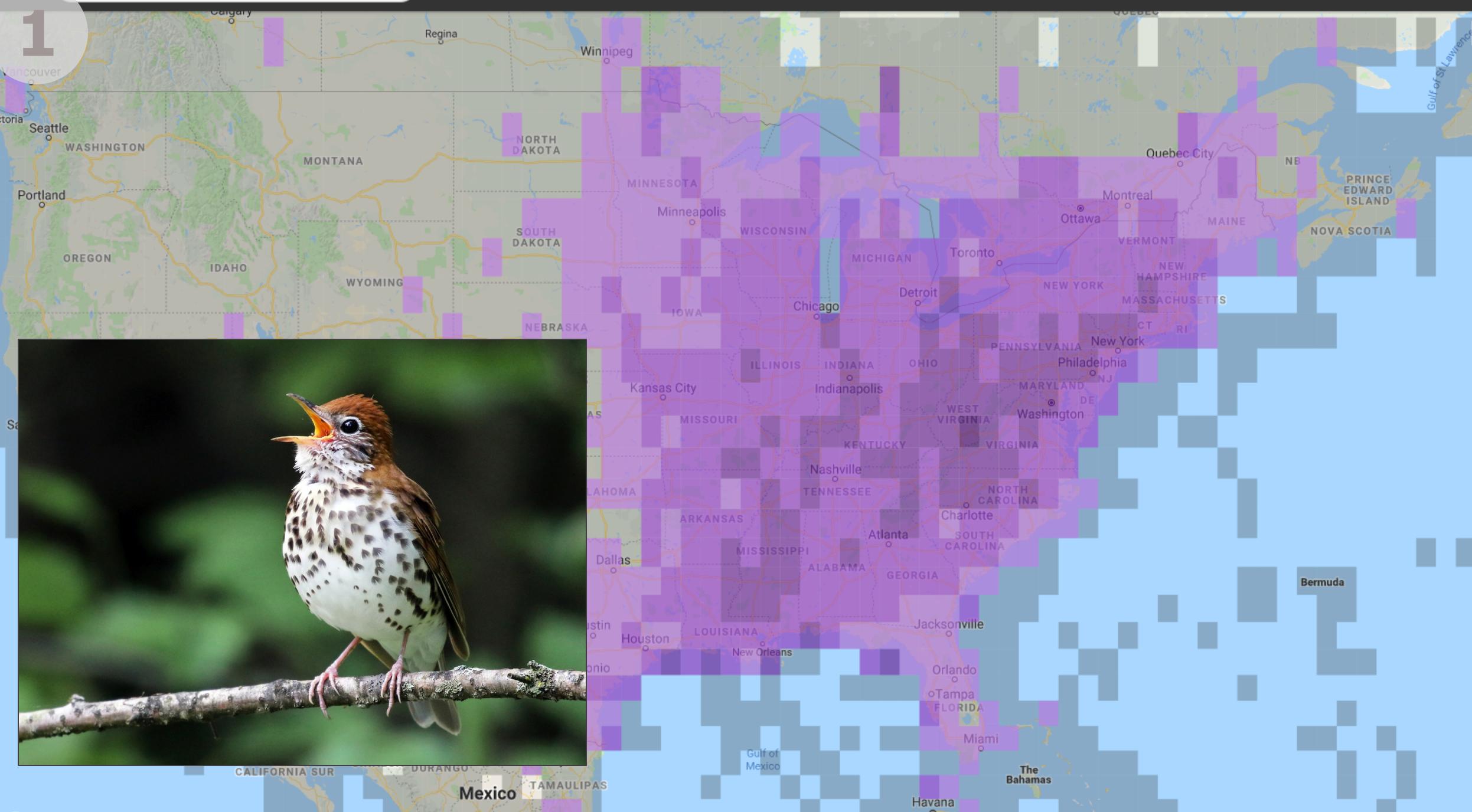


Date: Mar-May, Past 10 Years ▾

Location:  *Enter place name or address...*



1



1

[Jump to Species](#) Enter species name[All Media](#) 234

Species observed

 26

Species w/ photos

 2

Species w/ audio

 208

Species needing photos

 232

Species needing audio

Bufflehead

Last seen: [30 Oct 2018](#) by David MacDougall Audio needed
[Contribute yours](#)More:  1

© Sally Chisholm

Wild Turkey

Last seen: [27 Jun 2018](#) by John Murphy Audio needed
[Contribute yours](#)More:  1

© Steven Lamonde

Chimney Swift

Last seen: [18 Jul 2018](#) by Christine Whitebread Audio needed
[Contribute yours](#)More:  1

© Steven Lamonde

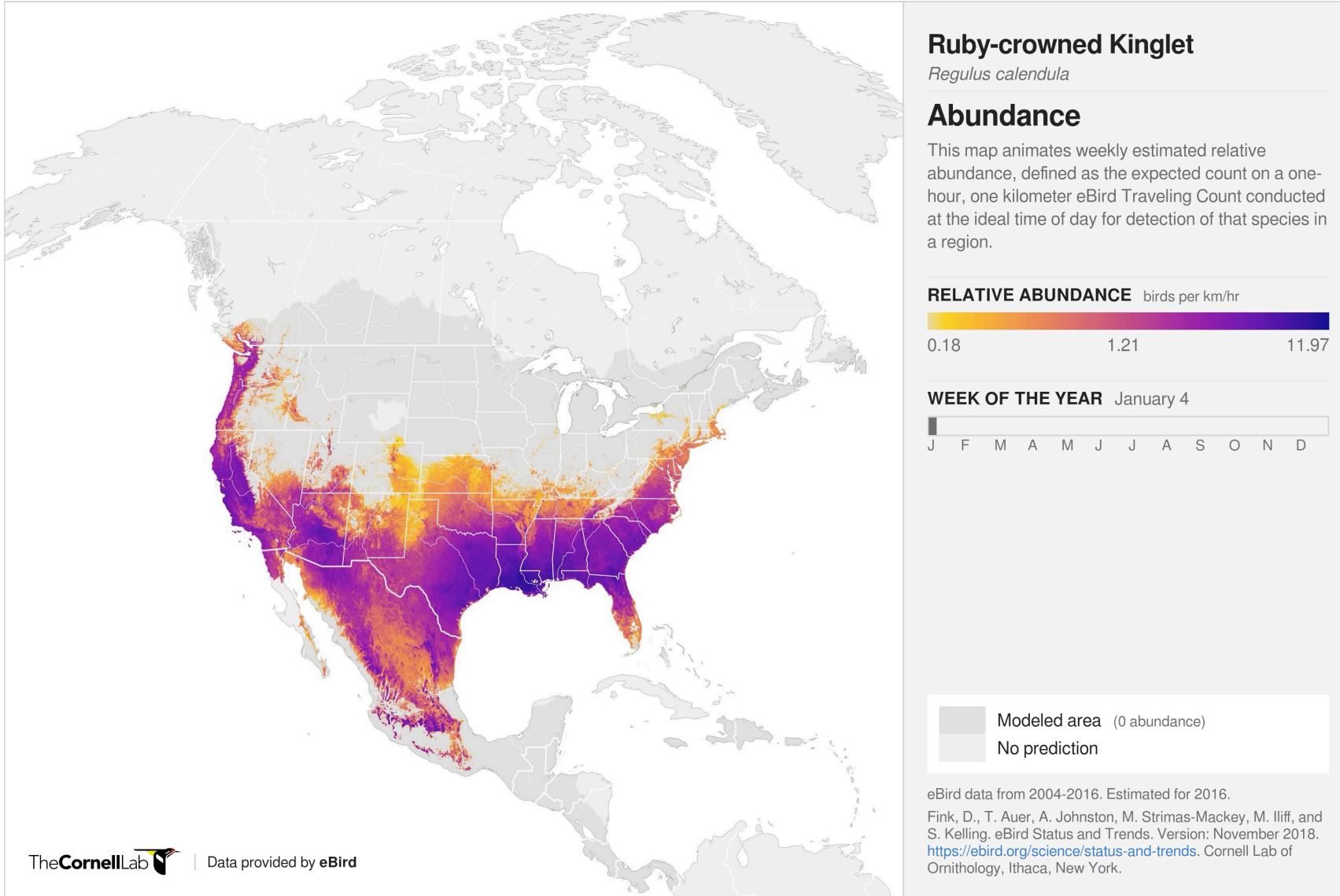
Greater Yellowlegs

Last seen: [26 Oct 2018](#) by Ellen Freda Audio needed
[Contribute yours](#)More:  1

© Kenneth Scott

eBird

Status & Trends



Bird Conservation Regions

Boreal Softwood Shield (BCR-8)

Boreal Softwood Shield BCR-81,489,663 km²**Non-breeding**
Dec 7 - Mar 8**Pre-breeding migration**
Mar 15 - May 31**Breeding**
Jun 7 - Aug 17**Post-breeding
migration**
Aug 24 - Nov 30**Mean relative abundance****0****1.72****1.41****0.88**

The average estimated relative abundance within the selected region for a given season. [Learn more](#)

Percentage of seasonal North American population**0%****13%****31%****5%**

This percentage is calculated as the sum of the estimated relative abundance within the selected region divided by the sum of the estimated relative abundance across North America, given that a majority of a species' entire North American range has been modeled for a particular season. [Learn more](#)

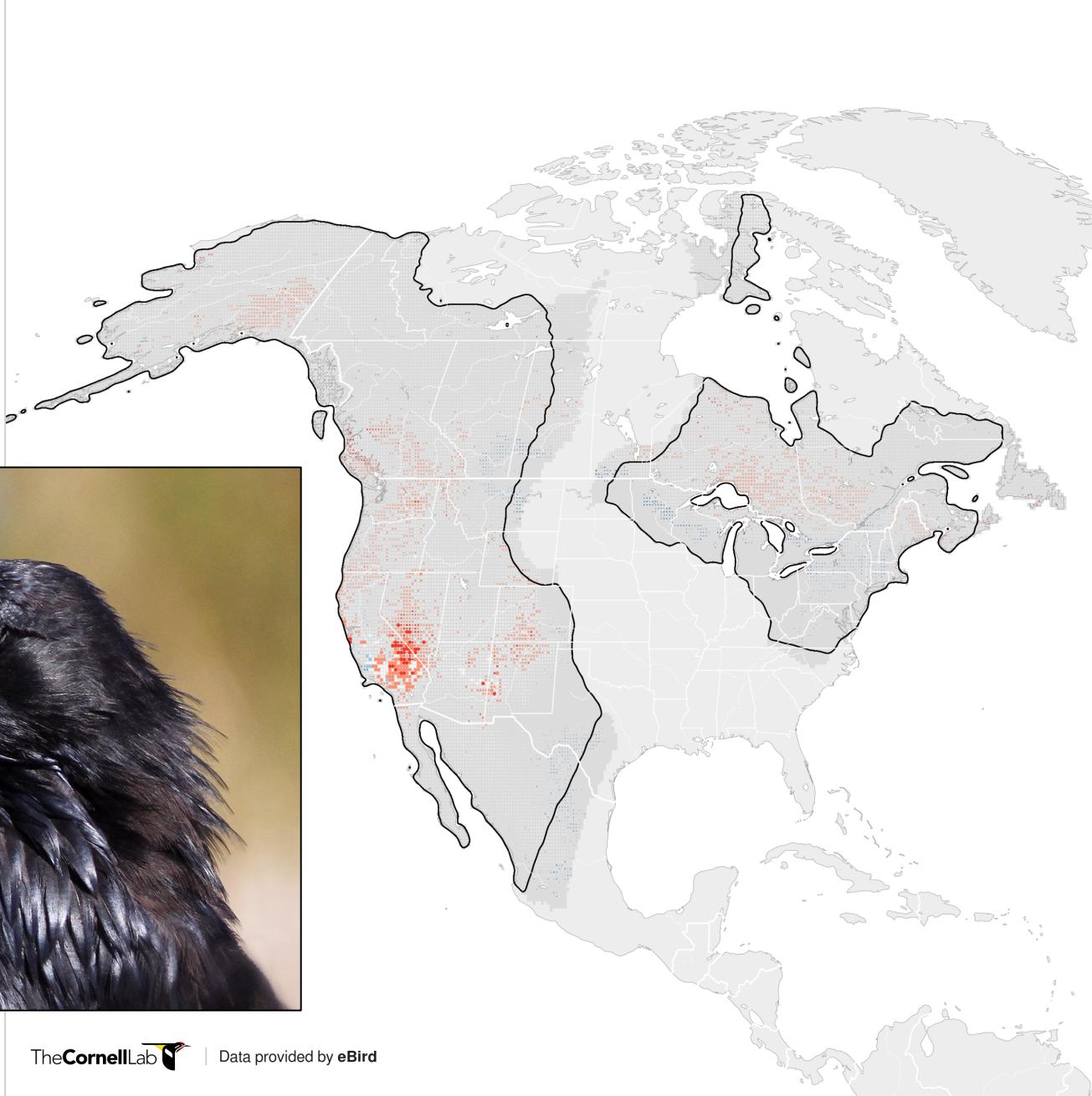
eBird data from 2004-2016. Estimated for 2016.

Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, M. Iliff, and S. Kelling. eBird Status and Trends. Version: November 2018. <https://ebird.org/science/status-and-trends>. Cornell Lab of Ornithology, Ithaca, New York.



The Cornell Lab

| Data provided by eBird



Common Raven *Corvus corax*

Trends: Breeding

This map depicts the ranked amount of change during the breeding season in estimated relative abundance across the years 2007-2016. Circles are colored by ranked increasing or decreasing trends and circle sizes are scaled by the maximum estimated relative abundance across 2007-2016. Light gray circles represent locations with trends not significantly different from zero.

CHANGE IN RELATIVE ABUNDANCE 2007-2016



*Trend not significantly different from zero

RELATIVE ABUNDANCE



Most reliable trends [Learn more](#)

Modeled area (0 abundance)

No prediction

eBird data from 2004-2016. Estimated for 2007-2016.

Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, M. Iliff, and S. Kelling. eBird Status and Trends. Version: November 2018.

<https://ebird.org/science/status-and-trends>. Cornell Lab of Ornithology, Ithaca, New York.

Species Distributions and Population Trends with Citizen Science Data

Daniel Fink

Wednesday 4 pm
Summit 4

Working with eBird Status and Trends data products in R

Tom Auer & Daniel Fink
Friday 12-2 pm
Summit 5-6

ebirdst 0.1.0

[Introduction - Data Access and Structure](#)

[Intro Mapping](#)

[Advanced Mapping](#)

[Non-Raster Data](#)

[Function Reference](#)

ebirdst: Access and Analyze eBird Status and Trends Data

Installation

Install `ebirdst` from CRAN with:

```
install.packages("ebirdst")
```

Alternatively, you can install the development version from GitHub with:

```
# install.packages("remotes")
remotes::install_github("CornellLabofOrnithology/ebirdst")
```

Vignettes

For a full introduction and advanced usage, please see the package [website](#). An [introductory vignette](#) details the data access and structure of the results. An [intro mapping vignette](#) expands upon the quick start readme and shows the basic mapping moves. The [advanced mapping vignette](#) shows how to reproduce the seasonal maps and statistics on the [eBird Status and Trends website](#). Finally, the [non-raster data vignette](#) details how to access additional information from the model results about predictor importance and directionality, as well as predictive performance metrics.

Quick Start

This quick start guide shows how to download example data and plot abundance values similar to how they are plotted for the [eBird Status and Trends Abundance animations](#). **Important note: after downloading the results, do not change the file structure.** All functionality in this package relies on the structure inherent in the delivered results. Changing the folder and file structure will cause errors with this package. If you use this package to analyze the results, you do not ever need to interact with the files directly, outside of R.

```
library(ebirdst)
library(viridis)
library(raster)
library(sf)
library(rnaturalearth)
```

Using eBird for science

Interested in using eBird data scientifically? Here are our key tips and tricks and the next opportunities to learn from the eBird analysis team in person.

Upcoming workshops

Members of the eBird analysis team are leading workshops at the American Ornithological Society Conference in Alaska in June 2019. [See all workshops.](#)

Best Practices for eBird Data I: Accessing and preparing eBird data for analysis in R

Tuesday 25 June 8am – 12 noon

Best Practices for eBird Data II: Modeling distribution and abundance using eBird data

Tuesday 25 June 1pm – 5pm

Working with eBird Status and Trends data products in R

Friday 28 June 12 noon – 2pm

Accessing raw eBird data

[Download raw data here.](#)

Once you have the data in hand, the R package *auk* can be used to extract and prepare eBird data for analysis. [Learn about *auk* here.](#)

Analysing raw eBird data

eBird data bring a number of challenges for analysis and it is important to consider how the data are generated when using them for analysis. We outline best practices for analysing eBird data in [this paper](#). Don't forget to look at the appendices! We also provide R code for producing species distributions with eBird here: <http://strimas.com/ebird-best-practices/>. Many of the principles outlined here apply to other analyses with eBird and other citizen science datasets.

Basic Dataset (EBD)

Updated monthly (15th of each month)



Access Until
17 Dec, 2019

Current Version EBD_relMar-2019 – Includes eBird data through Mar-2019

Prepackaged Options

World All species, locations, and dates	47.8 GB .tar
Sampling Event Data Effort data only	3.4 GB .tar

Please note these files are large and might take a long time to download. Files are delivered in .tar format.

Custom Download

Build a custom dataset using these options. Your request will be added to our download queue in the order it was received. We will send you an email when your download is ready. Files are delivered in .zip or .tar format, depending on size.

Species: All species

Choose species...

Enter species name...

Region: All regions

Choose region...

Date Range: All dates

Choose date range...

Options: Include unvetted data (?)

Submit Request

Name	Date Modified	Size	Kind
 ebd_relFeb-2018.txt	Today, 6:38 PM	183.16 GB	Plain Text
 eBird_Basic_Dataset_Metadata_v1.9.pdf	3/13/18, 10:47 AM	165 KB	PDF
 IBACodes.txt	11/1/12, 6:13 PM	127 KB	Plain Text
 USFWSCodes.txt	3/17/17, 10:33 AM	40 KB	Plain Text
 terms_of_use.txt	3/12/15, 4:27 PM	7 KB	Plain Text
 BCRCodes.txt	6/9/14, 10:46 AM	2 KB	Plain Text
 recommended_citation.txt	12/13/17, 12:08 PM	103 bytes	Plain Text



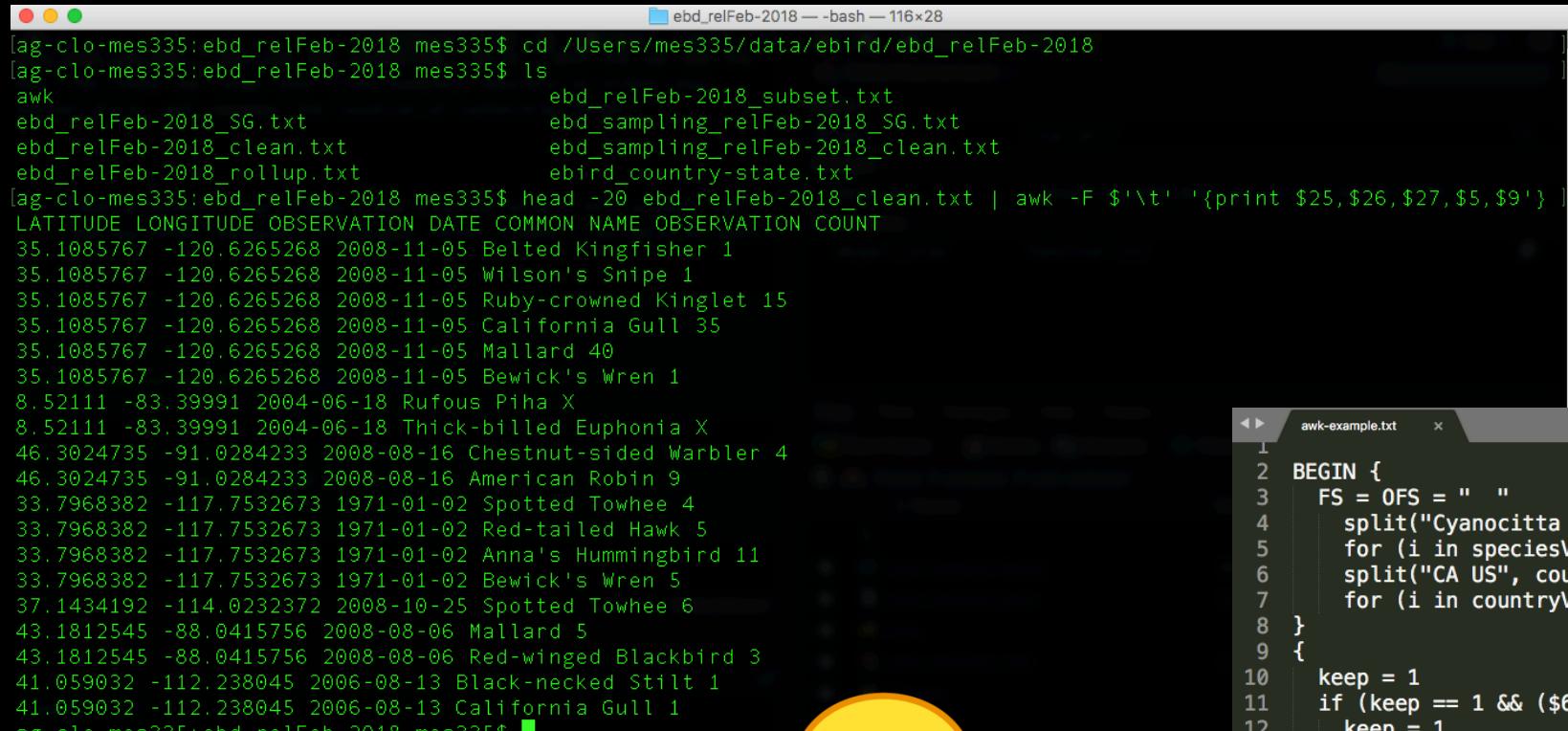


We need to make this

FILE

smaller

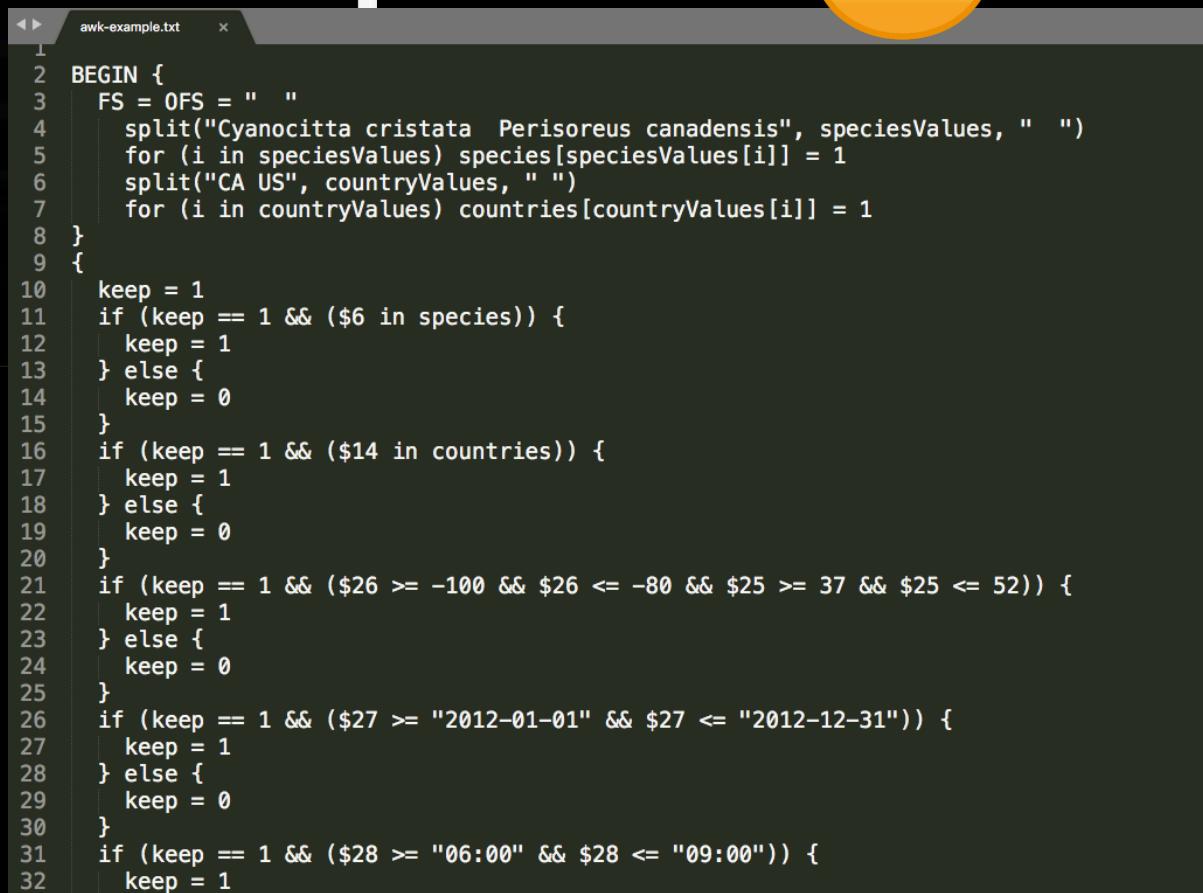
Terminal

```
[ag-clo-mes335:ebd_relFeb-2018 mes335$ cd /Users/mes335/data/ebird/ebd_relFeb-2018
[ag-clo-mes335:ebd_relFeb-2018 mes335$ ls
awk                               ebd_relFeb-2018_subset.txt
ebd_relFeb-2018_SG.txt           ebd_sampling_relFeb-2018_SG.txt
ebd_relFeb-2018_clean.txt        ebd_sampling_relFeb-2018_clean.txt
ebd_relFeb-2018_rollup.txt      ebird_country-state.txt
[ag-clo-mes335:ebd_relFeb-2018 mes335$ head -20 ebd_relFeb-2018_clean.txt | awk -F '\t' '{print $25,$26,$27,$5,$9}' ]
LATITUDE LONGITUDE OBSERVATION DATE COMMON NAME OBSERVATION COUNT
35.1085767 -120.6265268 2008-11-05 Belted Kingfisher 1
35.1085767 -120.6265268 2008-11-05 Wilson's Snipe 1
35.1085767 -120.6265268 2008-11-05 Ruby-crowned Kinglet 15
35.1085767 -120.6265268 2008-11-05 California Gull 35
35.1085767 -120.6265268 2008-11-05 Mallard 40
35.1085767 -120.6265268 2008-11-05 Bewick's Wren 1
8.52111 -83.39991 2004-06-18 Rufous Piha X
8.52111 -83.39991 2004-06-18 Thick-billed Euphonia X
46.3024735 -91.0284233 2008-08-16 Chestnut-sided Warbler 4
46.3024735 -91.0284233 2008-08-16 American Robin 9
33.7968382 -117.7532673 1971-01-02 Spotted Towhee 4
33.7968382 -117.7532673 1971-01-02 Red-tailed Hawk 5
33.7968382 -117.7532673 1971-01-02 Anna's Hummingbird 11
33.7968382 -117.7532673 1971-01-02 Bewick's Wren 5
37.1434192 -114.0232372 2008-10-25 Spotted Towhee 6
43.1812545 -88.0415756 2008-08-06 Mallard 5
43.1812545 -88.0415756 2008-08-06 Red-winged Blackbird 3
41.059032 -112.238045 2006-08-13 Black-necked Stilt 1
41.059032 -112.238045 2006-08-13 California Gull 1
ag-clo-mes335:ebd_relFeb-2018 mes335$
```



Awk



```

1 BEGIN {
2   FS = OFS = " "
3   split("Cyanocitta cristata Perisoreus canadensis", speciesValues, " ")
4   for (i in speciesValues) species[speciesValues[i]] = 1
5   split("CA US", countryValues, " ")
6   for (i in countryValues) countries[countryValues[i]] = 1
7 }
8 }
9 {
10   keep = 1
11   if (keep == 1 && ($6 in species)) {
12     keep = 1
13   } else {
14     keep = 0
15   }
16   if (keep == 1 && ($14 in countries)) {
17     keep = 1
18   } else {
19     keep = 0
20   }
21   if (keep == 1 && ($26 >= -100 && $26 <= -80 && $25 >= 37 && $25 <= 52)) {
22     keep = 1
23   } else {
24     keep = 0
25   }
26   if (keep == 1 && ($27 >= "2012-01-01" && $27 <= "2012-12-31")) {
27     keep = 1
28   } else {
29     keep = 0
30   }
31   if (keep == 1 && ($28 >= "06:00" && $28 <= "09:00")) {
32     keep = 1
33 }
```

auk: eBird Data Extraction and Processing in R

License [GPL v3](#) Mac OSX & Linux [passing](#) Windows [passing](#) coverage [79%](#)
[R](#) Peer Reviewed CRAN [0.3.2](#) downloads [13K](#)

Overview

eBird is an online tool for recording bird observations. Since its inception, over 600 million records of bird sightings (i.e. combinations of location, date, time, and bird species) have been collected, making eBird one of the largest citizen science projects in history and an extremely valuable resource for bird research and conservation. The full eBird database is packaged as a text file and available for download as the [eBird Basic Dataset \(EBD\)](#). Due to the large size of this dataset, it must be filtered to a smaller subset of desired observations before reading into R. This filtering is most efficiently done using AWK, a Unix utility and programming language for processing column formatted text data. This package acts as a front end for AWK, allowing users to filter eBird data before import into R.

Installation

```
# cran release
install.packages("auk")

# or install the development version from github
# install.packages("remotes")
remotes::install_github("CornellLabofOrnithology/auk")
```

auk requires the Unix utility AWK, which is available on most Linux and Mac OS X machines. Windows users will first need to install Cygwin before using this package. Note that **Cygwin must be installed in the default location** (`C:/cygwin/bin/gawk.exe` or `C:/cygwin64/bin/gawk.exe`) in order for auk to work.

Vignette

Full details on using auk to produce both presence-only and presence-absence data are outlined in the vignette, which can be accessed with `vignette("auk")`.



eBird Best Practices

- [Welcome](#)
- [1 Introduction and Setup](#)
- [2 eBird Data](#)
- [3 Habitat Covariates](#)
- [4 Modeling Encounter Rate](#)
- [5 Modeling Occupancy](#)
- [6 Modeling Relative Abundance](#)



Best Practices for Using eBird Data

Matthew Strimas-Mackey, Alison Johnston, Wesley M. Hochachka, Viviana Ruiz-Gutierrez, Orin J. Robinson, Eliot T. Miller, Tom Auer, Steve Kelling, Daniel Fink

2019-04-18

Welcome

This book is currently under active development. Please explore and give us feedback, but be aware that some sections are incomplete and others may still contain bugs.

Best Practices for Using eBird Data is a supplement to *Best practices for making reliable inferences from citizen science data: case study using eBird to estimate species distributions* (Johnston et al. 2019). This paper describes the challenges associated with making inferences from biological citizen science data and proposes a set of best practices for making reliable estimates of species distributions from these data. Throughout, the paper uses eBird, the world's largest biological citizen science project, as a case study to illustrate the good practices. This book acts as a supplement to the paper, showing readers how to implement these best practices within R using real data from eBird. After completing this book, readers should be able to extract data from the eBird database suitable for their own studies, process these data to prepare them for robust analyses, collect environmental covariates for modeling, and fit and assess models estimating encounter rate, occupancy, and relative abundance. Readers should be comfortable with the R programming language, and read the [Prerequisites](#) and [Setup](#) sections of the introduction, before diving into this book.

A preprint of the paper associated with this book is currently available on bioRxiv.

auk workflow

- 1 data access
- 2 filter
- 3 import
- 4 pre-process
- 5 presence-absence data

Applications

- 1 mapping and summarizing
- 2 occupancy model preparation
- 3 land cover covariates

Workshop format

- Participatory live coding
- Independent exercises
- Post-it notes
- Questions